7.7 DIFFRACTION AND REFRACTION OF SOUND WAVES

PRACTICE

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Understanding Concepts

1. Diffraction describes the ability of sound waves to move around an obstacle or to spread out after going through a small opening.
2. Sound waves refract, or change their direction, when they move at an angle from air at one temperature to air at a different temperature.
3. Lower frequency sound waves have long wavelengths compared to the openings that they encounter and diffract more than higher frequency sound waves, which have shorter wavelengths.

Section 7.7 Questions

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Understanding Concepts

1. The sound waves from the woofer will be easier to hear through an open doorway. These sound waves have a lower frequency and longer wavelengths, and thus can diffract more than the higher frequency (shorter wavelength) sound waves from the tweeter.
2. A high pitch sound has a higher frequency and a shorter wavelength than a low pitch sound (low frequency and longer wavelength). Thus, a low pitch sound would diffract more and be easier to hear.

Applying Inquiry Skills

3. Noise barriers primarily reflect the sound. Some of the sound energy is diffracted over the top of the barrier. Where there is space, earth berms are effective sound barriers particularly when planted with bushes and trees. The sound is reduced by multiple reflections in the bushes and trees. As well, the amount of noise diffracted over the top is diminished.

Making Connections

4. (a) Barriers affect highway noises of differing frequencies by diffracting lower frequency sound waves (longer wavelengths) more than high frequency sounds. Thus, the noise of a brake squeal would be reduced, but low pitch truck noises would not be reduced as much.
   (b) It is not feasible to install barriers on all roads because it would be costly and would make the area unattractive, except to the residents immediately behind the barriers.
   (c) Various answers could include suggestions to make the barrier of materials that absorb sound, such as fibreglass, rather than materials that reflect sound. Could also put plants and trees around barriers to help reflect and diffract sound.

7.8 THE INTERFERENCE OF SOUND WAVES

Investigation 7.8.1 Interference of Sound Waves from a Tuning Fork and Two Loudspeakers

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Purpose

The purpose of this investigation is to study the interference of sound waves produced by two sources of sound.

Question

Where are the areas of destructive interference located in the area surrounding the prongs of a tuning fork? Where are they located in the areas in front of two loud speakers producing identical sound waves?

Hypothesis/Prediction

(a) Having studied interference patterns of water waves from two sources in a ripple tank, it would be reasonable to assume that similar patterns would develop in the areas surrounding a tuning fork and in the areas in front of two loudspeakers producing identical sound waves. Each prong of the tuning fork and each speaker act a source of sound waves. Areas of